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Title

Bank Avalanche Model of Systemic Risk

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Supplemental Material

<https://escholarship.org/uc/item/1px7h8pk#supplemental>

BANK AVALANCHE

A bank avalanche occurs when more than one bank defaults at the same time.

AGENT BASED MODEL

Agents:

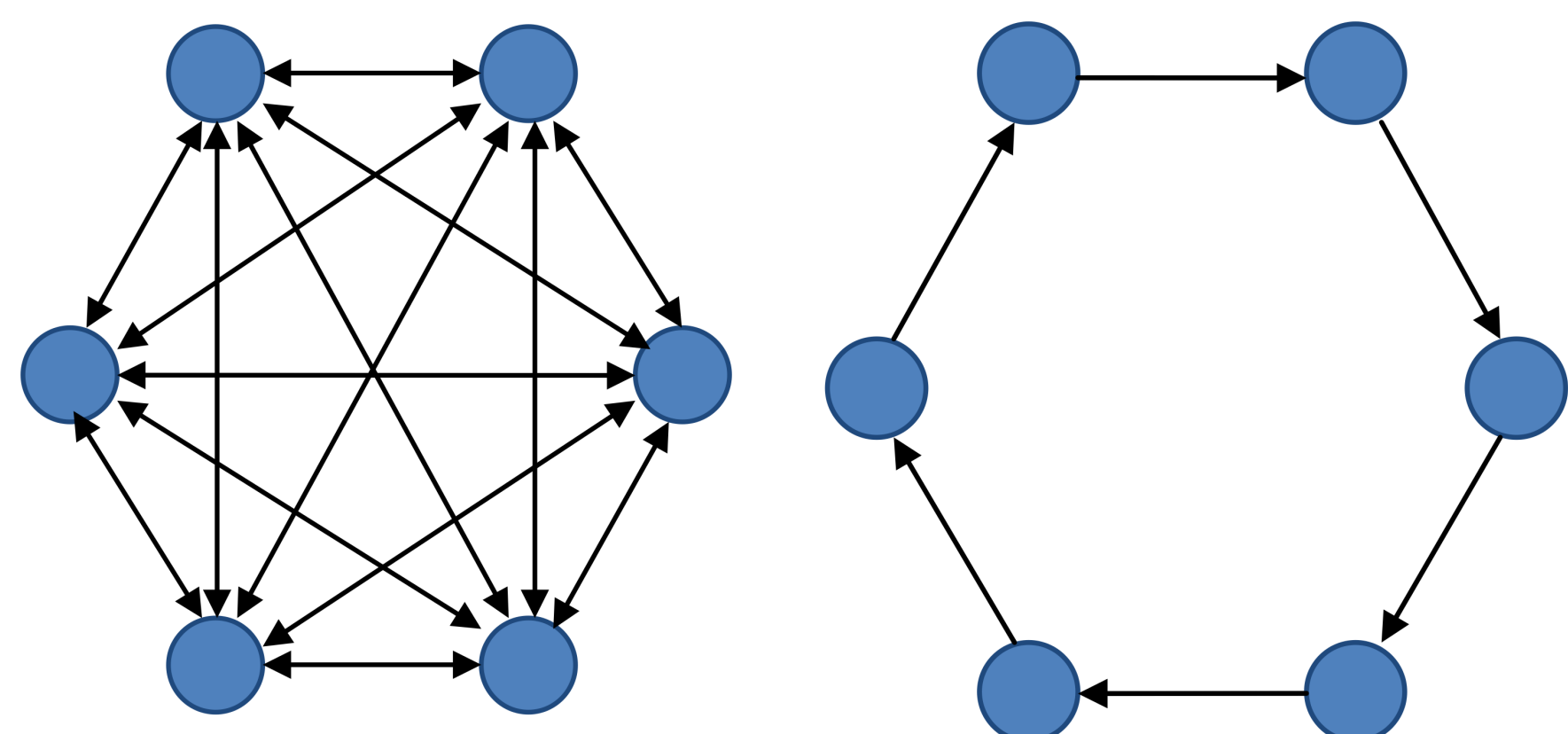
- Banks
- Non-Financial Transactors (NFTs)
- AIG-like Insurance Company

Definitions:

- Deposits: NFT asset given to bank.
- Loans: bank asset given to NFT.
- Euroloans: interbank loans.
- Eurodeposits: interbank deposits.
- Reserves: money kept at bank.

BANK NETWORKS

Banks make loans and accept deposits from other banks depending on the network type.



Circle network: banks trade interbank deposits and loans with neighbors.

Complete network: all banks trade interbank deposits and loans.

Unconnected network: banks cannot trade interbank deposits and loans.

Star network: centrally cleared transactions of interbank deposits and loans.

REFERENCES

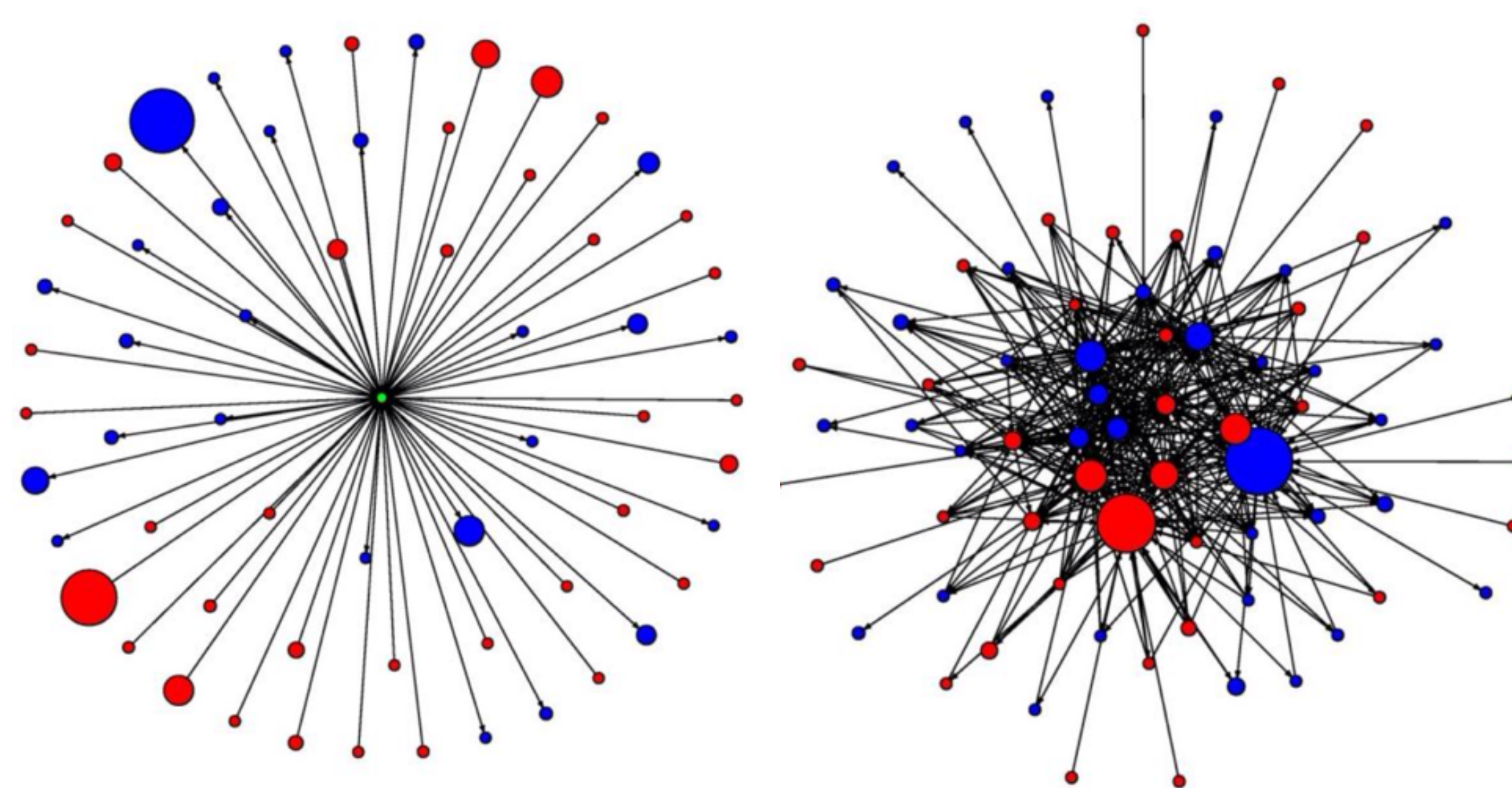
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RESEARCH QUESTIONS

- How does systemic risk build up in the financial system?
- Can systemic risk be characterized using an agent based model?
- How does insurance impact financial system stability?
- What regulatory policies mitigate build up of systemic risk?

MOTIVATION

- Efficient banking system facilitates economic transactions.
- Complex links in financial markets are the hallmark of modern finance.
- Bank runs occur when rational agents expect bank failure.
- Insurance on mortgages and bank failures traded in financial system.
- Interconnectedness of institutions, high indebtedness, and contagion explain the global impact of the financial crisis in the United States.



NETLOGO SIMULATION

NetLogo is an agent based model (ABM) software developed at Northwestern University. Bank Avalanche Model of Systemic Risk in NetLogo:

(1) Setup
 Bank-Network-Type: Complete
 Number-Of-Banks: 10

(2) Run
 a) "Setup" builds the model;
 b) "Run" starts and stops the model;
 c) "Reset" clears the model.

(3) Adjust
 Bank parameters:
 a) Bank loan rate to applicant (NFT): 0.6
 b) Percentage of bank assets in reserves: 0.4

Non-financial transactor (NFT) parameters:
 c) Rate NFT makes deposit to bank: 0.3
 d) Rate NFT withdraws bank deposit: 0.2
 e) Rate NFT repays loan: 0.1
 f) Rate NFT defaults on bank loan: 0.17

(4) Simulation
 ticks: 5
 Number of Simulations: 1000
 Simulation Count: 354.88

(5) Interpret
 Bank Lifespan: Mean Lifespan 10.78
 Profitability: Mean Profits Over All Simulations 0.78
 Avalanche Size: Mean Avalanche Size 3.84
 Avalanches per Simulation: Mean Avalanche Count 0.1

(6) AIG-like Insurance Company Options
 AIG-like insurance company parameters:
 a) Run simulation with AIG-like on or off: On
 b) AIG-like initial assets at setup: 10
 Additional bank parameters:
 c) Rate bank buys AIG-like insurance: 0.6
 d) Rate bank leverages balance sheet: 9

RESEARCH OBJECTIVES

- Compare financial stability of various bank networks.
- Examine increases in likelihood of firesale and bank avalanche.
- Compare networks with and without insurance company.
- Test effectiveness of various regulatory measures.